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SUMMER COURSES IN GEOGRAPHY

THE announcements of summer courses for 1904 sent out by our leading universities and normal schools contain the welcome evidence that geography will again receive, as it did last year, a very generous allowance of time and attention. This is especially true at the University of Chicago and at Columbia University, where unusually attractive opportunities for geographical studies and investigations will be offered, and at Cornell University, where last year's successful summer school of geography will be repeated under still more favorable conditions by the same strong corps of well-known instructors and geographers. So many and such valuable courses are announced by these and other educational institutions that every student and teacher of geography will be able to find interesting and profitable work in his chosen field. It is believed that many readers of the JOURNAL are planning to do such work this summer, and it is for their convenience that the Editors have prepared the following brief summary of the principal courses in geography and allied subjects.

COURSES IN GENERAL GEOGRAPHY

THE UNIVERSITY OF CHICAGO, Chicago, Ill. *The Principles of Geography.* Mr. L. H. WOOD.

A study of the general principles underlying the distribution of man and the development of human culture, and a special study of type regions on the basis of the principles developed. *June* 18–*July* 27.

COLUMBIA UNIVERSITY, New York City. *General Geography.* Miss CLARA B. KIRCHWEY.

This course is especially planned for teachers of nature study and geography in elementary schools, and covers the most difficult topics ordinarily presented in the introduction to a school geography. Lectures, laboratory work, and collateral reading. Sixty hours. *July* 6–*August* 17.

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HARVARD UNIVERSITY, Cambridge, Mass. *General Geography.* Mr. HENRY T. BURR, assisted by Mr. FREDERICK M. WILDER.

A course designed primarily for teachers of geography in grammar and high schools. The subjects treated in the lectures and illustrated in the laboratory and field work will include: Physical features of the lands; classification of land forms; the earth as a globe; meteorology; oceanography; geographical controls of the distribution of plants and animals; and geographical factors in the history of man. *July* 5–*August* 12.

DRAKE UNIVERSITY, Des Moines, Iowa. *General Geography.* Professor E. M. LEHNERTS.

A course planned for students and teachers desiring to review the general principles and facts of geography: (1) The fundamental facts and principles of mathematical and physical geography and their relation to the distribution of life and the industries of man; (2) a detailed study of the western hemisphere, with special emphasis on the geography of the United States; (3) the continents and countries of the eastern hemisphere and their commercial relations with the United States. Lectures, recitations, and laboratory work. *June* 20–*July* 29.

THE SCHOOL OF EDUCATION, THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Fundamental Concepts in Geography.* Associate Professor ZONIA BABER.

Topography; development of topographic forms. Climate; elements which make climate. Life; relation to climate and topography. People; relation to geographic controls. *June* 18–*July* 27.

STATE NORMAL COLLEGE, Ypsilanti, Mich. *General Geography.* Mr. ISAIAH BOWMAN.

A course of lectures on the continents, with references for reading. The lectures will give an account of the physical and climatic features now regarded as most evidently governing human occupation of the different portions of the earth, the more important political divisions and their relation to the physical geography, and the commercial and historic or social points of contact with our own national life. Four hours a week. *June* 27–*August* 5.

NORTHERN ILLINOIS STATE NORMAL SCHOOL, DeKalb, Ill. *General Geography.* Miss MARION WELLER.

A course in general geography from the teacher's point of view. Home geography; the earth as a whole; air and water; selected type studies. *June* 20–*July* 29.

MATHEMATICAL GEOGRAPHY

THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Elementary Mathematical Geography.* Assistant Professor KURT LAVES.

The form of the earth and its size; how to construct a map of a given area of the earth's surface; the rotation of the earth; the earth a member of the solar system; the seasons; climatic conditions; the tides. *July* 28–*September* 2.

GEOGRAPHY OF THE LAND

CORNELL UNIVERSITY, Ithaca, N. Y. *Physical Geography of the Lands.* Professor RALPH S. TARR.

A course in modern physical geography or physiography of the lands, with special stress placed upon the questions relating to the origin and life history of land forms and their influences on man. Four hours a week. *July* 7–*August* 19.

UNIVERSITY OF WISCONSIN, Madison, Wis. *Physiography.* Mr. S. H. BALL.

The course is designed for teachers and students desiring to take work in physical geography and dynamical geology. Lectures and excursions. *June* 27–*August* 5.

COLUMBIA UNIVERSITY. *General Geology.* Professor GRABAU and Miss MAURY.

A course in the elementary principles of geology from the physical point of view. The development of topographic forms; their relation to life; the making of geologic sections; reading and interpreting topographic maps and models; half-day excursions in the vicinity of New York. *July* 6–*August* 17.

THE UNIVERSITY OF CHICAGO, Chicago, Ill. Two courses:

Physiography. Professor R. D. SALISBURY.

The earth's features, treated with special reference to their origin and significance. Genetic geography. The course will have special reference to North America. *June* 18–*July* 27.

Research Course in Physical Geography. Professor R. D. SALISBURY.

Topics will be arranged with students individually, on conference with the instructor.

INDIANA STATE NORMAL SCHOOL, Terre Haute, Ind. *The Development of Land Forms,* with daily field and laboratory work. Professor CHARLES R. DRYER. *June* 27–*August* 5.

DRAKE UNIVERSITY, Des Moines, Iowa. *Physical Geography.* Professor E. M. LEHNERTS.

Land forms, and the agents and processes which have produced them; the atmosphere and the ocean; scientific weather forecasting; principles underlying the distribution of plant and animal life; the influence of the physical environment of man. Library readings, recitations, and laboratory work are supplemented by a study of the geology and physiography of Des Moines and its vicinity. Five hours a week. *June* 20–*July* 29.

GEOGRAPHY OF THE ATMOSPHERE

INDIANA STATE NORMAL SCHOOL, Terre Haute, Ind. *Meteorology.* Professor CHARLES R. DRYER.

A study of the atmosphere, weather, and climate, with daily laboratory work and instrumental observations. *June* 27–*August* 5.

NORTHERN ILLINOIS STATE NORMAL SCHOOL, DeKalb, Ill. *Meteorology.* Professor F. L. CHARLES.

A course in elementary science, with special reference to weather phenomena. Recording of local data; forecasting; laboratory work and recitations. *June* 20–*July* 29.

THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Elementary Meteorology and Oceanography.* Mr. H. H. BARROWS.

An outline course for teachers of physical geography and physiography. *July* 28–*September* 2.

CORNELL UNIVERSITY, Ithaca, N. Y. *Elementary Meteorology.* Mr. FRANK CARNEY.

The object of this course is to offer enough information to render the subject of meteorology and climatology more practical to teachers. Lectures (with slides), recitations, and assigned readings. *July* 7–*August* 19.

For a laboratory course in meteorology consult the courses mentioned in this paper under the heading *Field and Laboratory Courses.*

GEOGRAPHY OF PLANTS AND ANIMALS

THE UNIVERSITY OF CHICAGO, Chicago, Ill. Four courses:

Elementary Ecology. Dr. COWLES and Mr. HOWE.

Plants in relation to their environment. Field work, laboratory work, assigned readings, and lectures. *First term, June* 18–*July* 27

Physiographic Ecology. Dr. HENRY C. COWLES.

Origin, development, and death of the various plant associations, especially such as are found in the United States and Canada. *Second term, July* 28–*September* 2.

Research in Ecology. Dr. COWLES.

This course requires special training in ecology, and in related lines of study, especially geology and plant physiology.

Field Zoölogy. Dr. C. M. CHILD.

A study of the fauna of the region about Chicago, with special reference to the relations between animals and their environment.

COMMERCIAL GEOGRAPHY

CORNELL UNIVERSITY, Ithaca, N. Y. Three courses:

Commercial Geography. Mr. PHILIP EMERSON.

A study of important topics in commercial geography, with special relation to the position held by the United States in the commercial struggle of the present time. The history of commerce and industry; the physical controls of commerce; the great commercial staples and the development of allied interests; the commerce and industries of the United States and the leading commercial nations and regions. *July* 7–*August* 19.

Geographic Influences and Relations. Mr. R. H. WHITBECK.

Lectures and discussions designed to show the influence of physiographic and climatic conditions upon human activities: The influence of soil, coast line, mountains and valleys, plains and plateaus, gaps and passes, winds, rainfall, ocean currents, altitude and latitude, navigable inland waters; geographical causes leading to the location and growth of cities, the location and migration of industries, the establishment of transportation routes, and the prosperity of states and regions; man's reaction upon his environment, and his conquest of natural obstacles. *July* 7–*August* 19.

UNIVERSITY OF ILLINOIS, Urbana, Ill. *Economic and Commercial Geography.* Assistant Professor N. A. WESTON.

A study of the effects of geographical conditions on economic and commercial life. The physical features, resources, domestic and foreign trade, trade routes, transportation facilities, and industrial characteristics of the population of the United States and the leading foreign countries. *June* 13–*August* 12.

HARVARD UNIVERSITY, Cambridge, Mass. *Commercial Geography.* Dr. C. A. HERRICK.

A course of lectures, supplemented by class recitations, practical demonstration of methods, and excursions. A general outline of the subject with enough discussion and demonstration of methods to prepare teachers for work in secondary schools. *July* 5–*August* 12.

THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Commercial Geography for Teachers.* Assistant Professor H. R. HATFIELD.

The scope and method of commercial geography, its bibliography, text-books, and original sources. Special topics will be investigated. *June* 18–*September* 2.

For laboratory work in commercial geography consult courses outlined below.

FIELD AND LABORATORY COURSES

CORNELL UNIVERSITY, Ithaca, N. Y. Nine courses:

Laboratory Course in Physical Geography. Mr. CARNEY and Mr. HUBBARD.

A practical course to illustrate the methods and materials available for laboratory and field work in high schools. Attention is given to the possibilities open to the teacher in schools having limited laboratory equipment. Where desired by a teacher, personal suggestions will be made regarding the local field work he may carry on with his classes. *July* 7–*August* 19.

Field Course in Physical Geography. Professor TARR, Assistant Principal CARNEY, Mr. WHITBECK, and Mr. HUBBARD.

One afternoon each week is devoted to the study of physiographic phenomena in the field, and two days at the end of the week are given to all-day excursions. An excursion to Niagara is also offered in connection with this course, but attendance upon it is voluntary. An excursion to the anthracite coal fields is also open to students in this class. *July* 7–*August* 19.

Laboratory Course in Meteorology. Assistant Principal CARNEY.

A course planned for both grammar and high-school teachers. Some of the topics considered, discussed, and illustrated are: Non-instrumental observations—when to begin and over how long a period to continue the most simple observations; record-tables and methods of using them; instrumental observations—tabulation of records, averages; use of weather maps; filing of these maps and of newspaper clippings of notable meteorological phenomena; the equipment of a meteorological laboratory. *July* 7–*August* 19.

Laboratory Course in Geology. Mr. F. V. EMERSON.

A course intended to furnish an opportunity for the study of such geological phenomena as are capable of illustration by specimens, maps, and models. *July* 7–*August* 19.

Field Course in Geology. Professor A. P. BRIGHAM, Mr. F. CARNEY, Mr. F. V. EMERSON, and Mr. G. D. HUBBARD.

One afternoon each week and two Saturdays are devoted to excursions in the neighborhood of Ithaca. A voluntary excursion to the

anthracite coal fields of Pennsylvania is offered. Students of this course are also permitted to go on the Niagara excursion. *July* 7–*August* 19.

Laboratory and Field Work in Commercial Geography. Mr. PHILIP EMERSON.

Methods of teaching commercial geography and of studying commerce and industry: (*a*) In the factories and mills of Ithaca and vicinity; (*b*) in the laboratory by means of selected specimens, photographs, statistics, Government reports, and other material in print, and by the making of illustrative maps, charts, and diagrams; (*c*) in the conservatory and garden and on the farm. *July* 7–*August* 19.

Advanced Course in Dynamic Geology and Physical Geography. Professors TARR and BRIGHAM, with assistants.

Advanced field and laboratory work under the supervision of the instructors. The work will vary with the needs of the individual students. *July* 7–*August* 19.

Five-day Field Excursion. Professor R. S. TARR.

An excursion by rail, steamboat, and wagon, with frequent stops at points of interest. Its object is to study a large area, interpreting the phenomena observed, and noting the influence of physiography on the industries. The estimated expense is $40.00. All who desire to go are expected to notify Professor Tarr before June 1st.

THE UNIVERSITY OF CHICAGO, Chicago, Ill. Four courses:

Field Geology. Dr. W. W. ATWOOD (first term) and Mr. R. T. CHAMBERLIN (second term).

Training in stratigraphic, glacial, and other field determinations, together with mapping, sketching, and technical description. The field is the vicinity of the Dells of the St. Croix, Minnesota-Wisconsin.

Field Geology. Professor SALISBURY and Dr. ATWOOD.

Advanced field work, involving the systematic investigation of a formation or an area. The fields for 1904 will be in the West, or in Wisconsin. Dr. Atwood's party will spend the month of September in the vicinity of the Grand Canyon of the Colorado. Other parties, doing more special work, will study the former glaciation of selected mountain regions in the West, or in Eastern Wisconsin. *Second term, July* 28–*September* 2.

Field Geology. Professors T. C. CHAMBERLIN, SALISBURY, IDDINGS, and Assistant Professor WELLER.

Thorough and systematic work in close conformity to official standards, and, as nearly as possible, individual and independent. The course may form the basis for a doctor's thesis.

Field and Laboratory Course in Geology. Mr. L. H. WOOD.

The geography and geology of Chicago and its vicinity, studied in the field and from relief, topographic, and geologic maps. The course will include two field trips and three laboratory exercises weekly. For teachers and for those who wish to learn methods of field work. *First term, June* 18–*July* 27.

Map Study. Mr. H. H. BARROWS.

An advanced course in the interpretation of topographic and geologic maps. Especially for teachers who wish to introduce laboratory methods into physiographic and geologic work. *July* 28–*September* 2.

Physiographic Drawing, Chalk Modeling. Mr. GEORG THORNE-THOMSEN.

The primary purpose of this course is to give students of physiography ability to sketch topographic forms on the blackboard. *June* 18–*July* 27.

THE SCHOOL OF EDUCATION, THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Field Geography.* Associate Professor ZONIA BABER.

The class will visit Northern Illinois and Southern Wisconsin; thence by the way of St. Paul and the Mississippi River to St. Louis, where a week will be devoted to a study of the geographic exhibits of the World's Fair. Stops will be made at points of special topographic, geologic, or industrial interest. *July* 28–*September* 2.

UNIVERSITY OF MISSOURI, Columbia, Mo. *Physiography.* Professor C. F. MARBUT.

A course of study in the principles of physiography, taken up from the point of view of the needs of the high-school teacher. Laboratory work, field work, and occasional lectures and conferences.

UNIVERSITY OF WISCONSIN, Madison, Wis. *Field Geology.* Mr. S. H. BALL.

Students work in parties of two, and an area near Madison is assigned to each party. Each student makes his own topographic map and, with this as a base, prepares a geological map and a written report of his area. *June* 27–*August* 5.

GEOGRAPHY OF CONTINENTS AND COUNTRIES

COLUMBIA UNIVERSITY, New York City. *Geography of North America.* Professor R. E. DODGE.

This course will be devoted to a topical outline of the geography of North America, which will be treated in such a way as to bring out the causal relation existing between the physical and life conditions.

The needs of teachers in the intermediate and upper grammar grades will be constantly kept in mind, and the endeavor will be to show through the study of North America how each of the continents may be treated in school work. The lectures will be illustrated by maps, models, and photographs. Training will also be given in the use of reference books, and in the organization of subject-matter by means of special papers on selected topics to be prepared outside of the classroom and submitted for criticism. *July* 6–*August* 17.

THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Economic Geography of North America.* Assistant Professor GOODE or Mr. WOOD.

A study of the natural resources of the continent as factors in its economic development. The geologic structure, the physiography, and the climate, treated as factors determining or affecting the location and utilization of mineral resources, arable and grazing lands, forests, etc. The influence of these various resources on the settlement and development of the continent. *July* 28–*September* 2.

THE SCHOOL OF EDUCATION, THE UNIVERSITY OF CHICAGO, Chicago, Ill. *Continental Study: North America as a Type Continent.* Associate Professor BABER.

Effect of the geography of North America upon the development of its civilization. Means of study. Methods of teaching. Map drawing and sand modeling. *June* 18–*July* 27.

CORNELL UNIVERSITY, Ithaca, N. Y. Three courses:

The Geography of the United States. Professor A. P. BRIGHAM.

A summary study is given of the evolution of the North American continent. The lectures are then mainly devoted to the several physiographic regions of the United States. The origin of the land forms is explained, and especial attention is given to the control exercised by geographic conditions upon the colonization, social life, commerce, and military history of the United States. Under the last head, military movements in the Revolution and selected campaigns of the Civil War will be studied. Forestry and forest reserves, the arid lands and irrigation, and the development of lines of travel and communication are among the topics treated. *July* 7–*August* 19.

The Geography of Europe. Professor R. S. TARR.

A consideration of the physiographic features of Europe and their influence upon the history and industrial development of the several nations. The principal sub-topics are: (1) Physiography of the continent and its development; (2) climatic conditions; (3) natural resources; (4) influence of these various physiographic features upon

race characteristics, early movements of people, development of navigation, modern national development, and location of leading cities, both in the past and present. Fully illustrated with lantern slides and maps. *July* 7–*August* 19.

The Geography of Tropical Countries. Mr. G. D. HUBBARD.

This course is designed to meet the demand for a better knowledge of tropical lands, a demand made by their growing importance, as markets and sources of raw materials, in the industrial development of temperate lands. *July* 7–*August* 19.

INDIANA STATE NORMAL SCHOOL, Terre Haute, Ind. *Geography of the United States, Physical and Political*, with map drawing on mathematical projections. Professor CHARLES R. DRYER. *June* 27–*August* 5.

SPECIAL METHODS IN GEOGRAPHY

COLUMBIA UNIVERSITY, New York City. *The Teaching of Geography.* Professor DODGE and Miss KIRCHWEY.

This course will be devoted to a consideration of the course of study in geography for elementary schools, and to the general principles underlying good geography teaching. The lectures will consider the following topics: The scope of geography in elementary schools; the present status of geography in elementary schools; the point of view to be held by the teacher of geography; the division of the course of study; the knowledge of location and how it should be secured; the relation existing between geography and other subjects, especially nature study, hand work, and history; excursions and reference work in geography; the use of maps and illustrative material; commercial geography in the upper grades; the use of a text-book; references for teachers and pupils; thought questions in geography; the teaching of industries, etc. A course of study will be outlined and suggestions given as to the material available for presentation in each of the grades, as to the general manner of treatment adaptable to pupils of different ages; certain topics like home geography and the topical treatment of continents will be treated fully. Certain difficult problems like the teaching of latitude and longitude, the understanding of a map, etc., will be treated in such detail as time will permit. Each pupil will be called upon to outline some special topics in order to give training in the use of references and in the organization of subject-matter. These topics will also be later outlined as lesson plans to be given in certain grades, and a certain number of class hours will be devoted to the criticism of good and bad outlines and plans. Especial attention will be

given to ways of teaching the present course of study in the New York City schools. *July* 6–*August* 17.

UNIVERSITY OF MISSOURI, Columbia, Mo. *The Teaching of Geography.* Professor C. F. MARBUT.

A course of lectures and occasional field and library work on the teaching of geography in the grades, with special emphasis of the public-school geography, the methods of teaching, the aim of the subject, and the sources of material for properly illustrating it. The geography of the whole public-school course will be considered, though most emphasis will be laid on the work in the sixth, seventh, and eighth grades.

DRAKE UNIVERSITY, Des Moines, Iowa. *Methods in Geography.* Professor E. M. LEHNERTS.

The work in this course includes both a review of the subject-matter of school geography and the special consideration of methods of teaching it. A course for the grades is outlined, and the matter and the methods of presentation at the several stages are discussed. Lectures, recitations, and laboratory work. *June* 20–*July* 29.

CORNELL UNIVERSITY, Ithaca, N. Y. Three courses:

Type Studies in Geography for Grammar Grades. Professor CHARLES A. MCMURRY.

The selection of important topics as types in geography; illustrations of type studies in North America, Europe, and other lands; the principles of method illustrated by such type studies; relation of such studies to text-books in geography; the course of study in geography, and the value of earlier lessons in the interpretation of later lessons in the course; the method of oral treatment of some topics; reviews and comparisons. *July* 7–*August* 19.

Home Geography. Professor CHARLES A. MCMURRY.

An analysis of those geographical facts and materials which lie within the range of the children's senses. The necessity for this study as a basis for later book and map studies of the large world beyond is illustrated. The topics of home geography; study of excursions with classes of children; the oral treatment of topics in classroom work; the relation of home geography to the later geography studies and to text-books; a course of study showing the leading topics in this transition from the home neighborhood to the state and the United States; leading topics of the home state and their treatment; the study of the earth-whole in the early years, and its relation to the child; means of illustrating the earth-whole and its parts. *July* 7–*August* 19.

Aims and Problems in Geography. Supervisor R. H. WHITBECK.

Designed more particularly for grammar school teachers. The course consists of lectures, discussions, and laboratory exercises, dealing with the actual problems of the classroom. Some of the topics treated are: The chief aims in teaching geography; the relative value of different kinds of geographical knowledge; methods of conducting the recitation; the proper use of the text-book by pupils and by teachers; the use and misuse of supplementary books; the value of studying things instead of about things; map modeling, map drawing, and the use of outline maps; written and oral exercises, reviews, tests, and examinations; the proper scope and limitations of geography. *July 7–August 19.*

MICHIGAN STATE NORMAL COLLEGE, Ypsilanti, Mich. *Teachers' Geography.* Mr. I. BOWMAN.

The course is planned for teachers and advanced students, and deals with topics in mathematical geography, map projections, and the geography of the atmosphere. Lectures, recitations, and laboratory work. *June 27–August 5.*

THE DELTA OF THE MISSISSIPPI*

BY FRANCIS E. LLOYD
Professor of Botany, Teachers College, Columbia University

DURING the summer of 1900 I undertook a trip to the Delta of the Mississippi River and the islands which lie to the eastward, for the purpose, primarily, of studying the vegetation of that bit of country. Though but a very amateur in matters of geography, I have to confess that my interest in the Delta well-nigh eclipsed my more immediate interest in its plants, until, at least, my mind regained its equilibrium. I shall in the present paper attempt to give an account of my observations of this interesting region, having reference chiefly to that portion commonly known as the Delta, and not to that larger area bordering the lower Mississippi, which in recent geological times has been built up by the same processes which may now be seen in operation in the Delta itself. (See Map 1.)

The only practical way of exploring such a region is by means of a boat of light draft. The waterways, though tortuous, are continuous and the water, for a very considerable distance from the land, shallow.

*For folding map of the Delta of the Mississippi see inside front cover.

For this reason the party of which I was a member hired a "scow schooner," ordinarily used for oystering. This is the finest kind of craft for knocking about such waters. Roomy, unpainted, stiff, drawing little water, one can creep into the veriest bits of mudholes, and *get out again;* being roughly built and no better finished, a naturalist has to take no precautions for the preservation of appearances; and being roomy, there is plenty of space to sleep on the deck, under mosquito netting, and thus be cool at night. A few weeks' cruise on such a boat is an ideal experience.

On approaching the Delta from the east, with still a wide expanse of water ahead, and in the distance the low stretch of green marsh and a curious, jagged sky-line of willows, reaching far to the north, one will, perhaps, receive a suddenly applied demonstration that the land is not so far off as it seems. In a word, the boat is aground. Instinctively, she is headed up to the wind, if possible, and all hands jump overboard, a most comical procedure that never fails to evoke laughter and remarks from one's companions. In this concrete way we learn that beneath the mud-laden water the bottom extends out to sea for many miles at a depth of two or three feet, and less in places. Such an experience demonstrates to us what the great river is doing. Its water, opaque with sediment, carries most of this over the shallow, submerged extension of the Delta. Some of it, however, gradually settles to the bottom, and thus slowly raises the level of the sea floor, while the rest of the detritus is precipitated farther seaward. Deeper channels in this platform are eroded by the currents, which extend out from the various mouths of the river. Low, submerged mounds are formed by eddies, and the whole vertical contour is modified from time to time by storms. The constant change makes navigation especially dangerous. You are compelled literally to feel your way along, even in a small "scow," by means of an oar, a man on each bow calling off the depth in feet and inches. It is only by the submerged channel formed by the South Pass current that approach may be had by ocean-going vessels, and this calls for skilled pilotage.

From a considerable distance the Delta appears as a very low extent of land, with even, horizontal contour. The color is a uniform dark green, the whole landscape being somber and monotonous, especially in the failing light of evening. The impression of the contour, however, is deceptive, for a closer approach shows that the land is broken up into a maze of bays, "cut-offs," and lagoons, forming necks of land and islands of all sizes and shapes. An adequate notion of

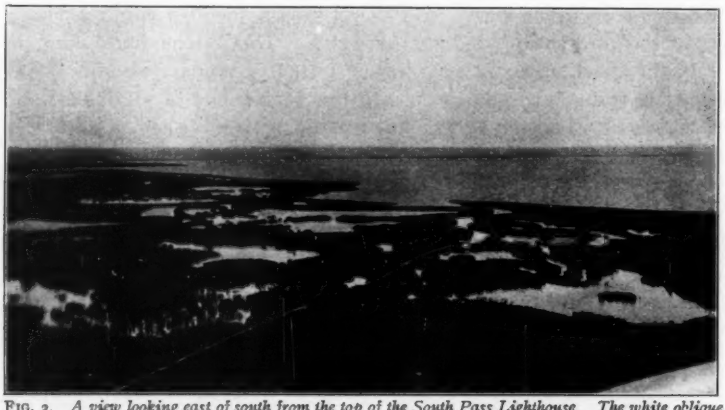

FIG. 2. *A view looking east of south from the top of the South Pass Lighthouse. The white oblique line is a board footpath to a boat mooring. The dark line parallel to the horizon is a sand spit extending westerly from the mouth of the river.*

the complexity of the land forms may best be had by getting a view from a point of vantage at the top of the South Pass Lighthouse. Such a view is seen in the second figure and no further word of description is necessary. How this horizontal contour is brought about is to be explained, at least in part, by the secondary action of the waters outside of the Delta. Were it not for the tidal action and the effects of wind and currents, the Delta would be built up regularly, as is suggested by the more even contour line of its submerged portion. But, given these factors and a soft, homogeneous, flat, low-lying alluvial deposit to work upon, together with occasional unevenness, due to buried or partly buried detritus of small and large pieces of tree trunks, branches, and the like, which float down the river and are deposited, we can easily understand how the irregularities of contour arise. These help to direct the erosive forces, and thus are a factor in producing the result above described.

Our entrance to the Delta was made through Cubit's Gap on its eastern side. This is the main channel of a secondary delta, caused, at some period of extraordinary flood, by the main current breaking through its low-lying bank at a weak point. The lateral stream thus originated will in time build up a form similar to, but smaller than, the chief delta. At occasional points along the shore are encountered fishermen's houses, built on the low-lying marshes. Their situation is precarious, because the muddy surface is frequently submerged, and the run of rough water during storms is sometimes disastrous. The danger is

reduced by building upon long spiles, which lift the house above the surface. The experience of entering such a dwelling is certainly novel. The fisherfolk are chiefly Italians, who are very hospitable. Their boats are single-masted luggers of light draft, well built and graceful.

Upon entering the main stream of the Mississippi, we follow the stream in its southeasterly course. At once the appearance of our surroundings changes. A few minutes previously a whole sea was behind us, and the feeling we experienced was that of approaching the land. Now it seems as if we are floating on a river inland, its banks clothed with a tall grass (*Phragmites*), or "canes," as they are locally called, which shut out the distant view. (Fig. 3.) Trees of black willow, which form a continuous growth farther up stream, are to be seen occasionally along the bank, and the "canes" are often overgrown by a species of ampelopsis (*Ampelopsis arborea*), but more frequently and densely by a leguminous vine (*Vigna glabra*), bearing numerous yellow, pea-like flowers. Of these plants, the "cane" is the most interesting, for its growth contributes very materially to the stability of the muddy bank. It spreads by runners, some of which project out into the stream, extending downward with the current as much as thirty meters or more. Those which take root contribute to the formation of hummocks, which, by their close juxtaposition, make a firm framework to support the soft materials of the bank.

FIG. 3. *A view of the river bank of the South Pass showing the dense growth of canes (Phragmites.)*

From the western bank of this part of the Delta stretch considerable reaches of low, swampy meadow land, clothed with grasses and weedy plants, among which a sensitive plant (*Mimosa strigillosa*) is very common, and responds rapidly to the touch by closing tightly its leaflets and bending down its leaves.

Continuing the course down stream, we come suddenly to a parting of the way in three directions—quite the reverse of the ordinary experience in floating down stream. Instead of the tributaries feeding the stream, the stream divides its water among its distributaries (here the three main Passes) of which the middle, in line with the chief stream, is the South Pass, and the way we chose. Once well into this arm of the river, the most illuminating evidence of the work of the great river is before us.

If we climb the bank in this region, we can look beyond a few hundred feet out upon an expanse of salt water. (Fig. 4.) The highest part of this land is beneath us, only a few feet above the level of the swiftly-running stream, and an equal distance from it. This low ridge is a lateral barrier, built up from the sediment of the river laid down at times of flooding, and allowed to maintain a level above that of the sea level. In this manner a natural aqueduct of the stream's own making guides it to its mouth. From the ridge, the bank slopes more

FIG. 4. *A view looking north along the western bank of the South Pass. On the right one sees the back-bay waters, and the low, flat marsh contiguous to them. The highest ground, near the river, is indicated by the willow. Note the slope of the ground on the left of the ridge, and the sudden fall on the right. In the foreground part of a fisherman's house, and of the "scow schooner" mentioned in the text. The fishermen's houses are always built on stilts to protect them from floods.*

FIG. 5. *South Pass, from the lighthouse, looking north. Note the river flowing between the narrow irregular strips of land. The picture shows an outgoing steamship.*

gradually away toward the salt water. The canes of the higher level give way to a lower, stiff-leaved grass (*Spartina*). As one walks through this bristling foliage, thousands of small amphibious crabs scurry in all directions. It is in such low-lying, densely grassy places that the alligator builds its nest, consisting of a mass of dead grass packed about the eggs, which are laid in considerable numbers.

At the mouth of the South Pass is the small village and Government station of Port Eads, the seat of the jetty operations. The effort of the engineers who are managing these operations are so to control and direct the stream as to keep a ship channel open up to and above the mouth. This involves a vigilance as eternal as the stream itself. From the top of the South Pass Lighthouse may be had a most instructive panoramic view. In Figure 2, which is a view looking seaward, besides the details referred to above, we see in the distance a long, slender spit, which is formed by the deposit brought about by the influence of the still "back-bay" waters upon the moving waters on the outside. This narrow stretch of land outlines most perfectly the ideal form of the Delta. In the map (Map 1, Fig. 1) this is seen on the western side of the mouth.

Looking north we see the South Pass with a vessel on its surface, and the irregular and, at times, very narrow strip of land which walls in the current.

Once outside, and we bear northeasterly to pass around the N. E. Pass on our return to our "port of departure." After passing out of the ship channel, we are again in shallow water until we cross the channels extending from the other mouths, in the vicinity of which there are large numbers of very curious islands, all nameless, well termed collectively the "mud lumps." They consist of a very compact black or yellowish clay, overlaid with a thin top soil. In size they vary from a few square rods to perhaps fifty acres, and their surface is three to

nine feet above sea level. They appear to have an origin quite different from the other islands—for their topography suggests very strongly that they have been erupted from below the surface of the water. I can not say, however, that this is true. The vegetation of these dreary spots is sparse, and weedy in character. The lack of natural charm is emphasized by the frequent abundance of flies, which buzz about one in a most threatening manner and bite viciously. One very interesting little plant we found, which evidently had been brought down the stream—a little floating fern, *Azolla Caroliniana*. This was growing in a little cove of a mud lump near Pass á Loutre. On islands near by we found immense flocks of pelicans.

After leaving the North Pass we sail northwesterly for Bird Island, a long, slender strip of alluvium overlaid on the seaward side by sand in sufficient quantities to be heaped up by the wind into small beach dunes. Here we find the beautiful sea oats, *Uniola paniculata*, which add a strikingly graceful element to the otherwise monotonous grassy, beach dune vegetation.

The most important grass is *Panicum amarum*, since it is a sand binder, and is largely responsible for the topography of the beach dunes, which are found at the limit of ordinary wave action. (Fig. 6.) Growing chiefly at this point we find the common tropical beach convolvulus, *Ipomoca pes-caprae*, so called on account of the resemblance of the leaf to the hoof of a goat. The runners of this plant attain a length of 120 meters on the Florida strand, although the longest I found in the Delta region were only a fourth as long. The plant has fine reddish-purple flowers, seen in their beauty only in early morning. There is another similar plant, found in Breton Island, with lobed leaves and white flowers.

Bird Island serves as a type of many other islands, such as Breton Island and Cat Island, in that the foundation is alluvium. Overlying this, on the seaward side, which is also the windward side with respect to the prevailing wind, is a layer of sand, more or less deep, according to the size of the island. On the largest, enough is present for the making of large dunes, in the lee of which stretches of sandy plains are found. On these islands the vegetation is composed of pine trees and palmettos, and is very similar to the vegetation of the coastal plain of the mainland.

One other type of island remains to be mentioned, of which there are many examples on our course from Bird Island to Cat Island, west of Chandeleur Sound. They are similar in origin to the sandy islands, but are peculiar in the circumstance that the sand is absent and small shell

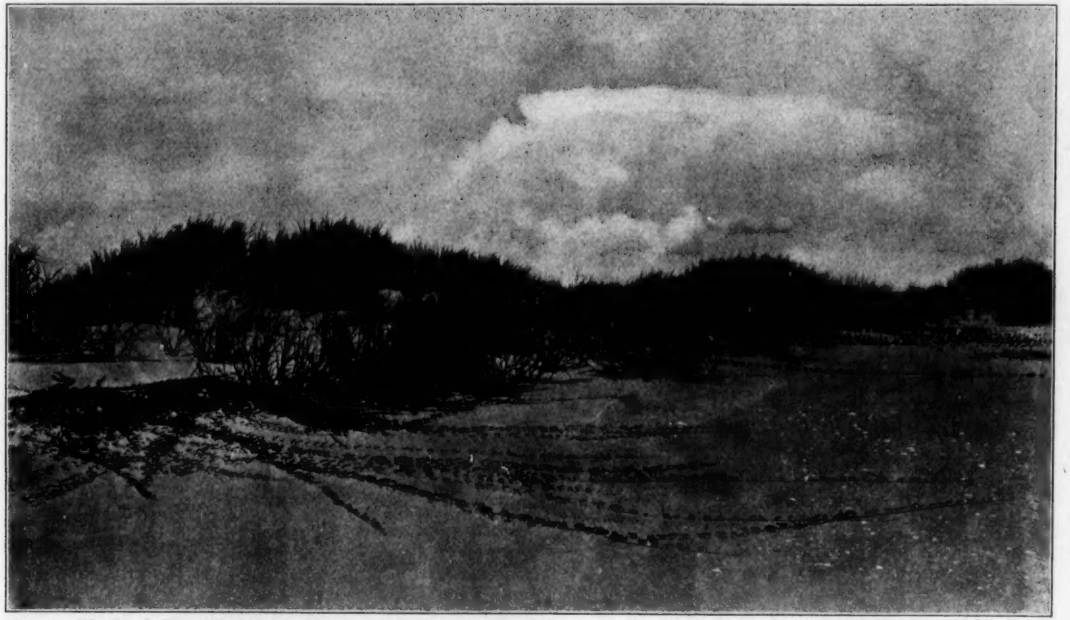

FIG. 6. *The Beach Dunes formed by a coarse, gray-green grass (Panicum Amarum). Two species of beach morning-glory are to be seen creeping over the sand.*

FIG 7 *A "shell-dune," with its very sparse, weedy vegetation. On the right is the muck marsh with its uniform clothing of a succulent (Batis Maritima).*

fragments take its place. (Fig. 7.) They are therefore appropriately called "shell islands." The shells are always found forming a continuous narrow dune on the seaward edge of the island, quite parallel and adjacent to the very narrow, muddy beach. (Fig. 8.) The remaining flat, muddy, and marshy surface supports a growth of low succulent plants (*Salicornia* and *Batis*), and, less frequently, of the white mangrove (*Avicennia nitida*), which is here at its northern limit. This plant is very interesting on account of its air roots, which project upward out of the mud, and enable the plant to respire. For a similar purpose, the other succulent plants have corky outgrowths on their lower parts.

The shell dunes, on the other hand, produce a wholly different and very scant weedy vegetation of amaranths, goose-foots, some trailing vines, euphorbias, and the like. (Fig. 7.)

The shallow waters of all the islands are very productive of oysters, shrimp, and small fish. The latter are caught by means of a "cast

FIG. 8. *An ideal section of a small island with a shell-dune on the windward shore. The form of the dune as seen in transverse section indicates the direction in which it is moved by the surf.*

net," a circular net, which, when thrown with skill, brings death to dozens of mullet or thousands of shrimp. This form of net is especially adapted to shallow waters, although it is used also throughout the West Indies. I am told that it is found in the Nile delta also, and I have seen it on the Rhine.

One of the most unique experiences I ever had was on a dark night at Breton Island. Taking the skiff, with the purpose of throwing the

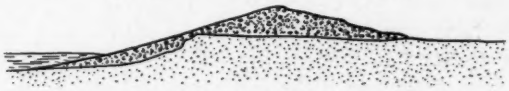

FIG 9. *Another form of a shell-dune.*

cast net, we saw, as we rowed, thousands of phosphorescent streaks of light shooting hither and thither through the water, like comets in a black sky. It was almost beyond belief, but all caused by the sudden scurry of mullet as the boat frightened them by its approach.

The limit of space has prevented a more detailed account of what we saw upon this delightful and instructive trip. I have tried, however, to bring out the salient features of our experiences of three weeks, which will never be forgotten. We were fortunate in landing at Biloxi, Miss., just in time to escape the terrors of the storm which laid waste the city of Galveston.

THE MOTIONS OF THE EARTH*

PART II

BY FOREST R. MOULTON
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THE REVOLUTION OF THE EARTH

THE question of the revolution of the earth around the sun is quite distinct from that of its rotation on its axis, some of the ancient philosophers having held to one theory and not to the other. Aristarchus (310–250 B. C.) was the first to systematically develop the heliocentric theory, that is, to explain celestial phenomena by supposing that the earth and planets revolve around the sun. He could give no proofs of its correctness and it was quite generally abandoned. The most celebrated astronomical work of the ancients was the Almagest of Ptolemy (100–170 A. D.) which dominated this field of science for fourteen centuries. Ptolemy showed in it that all the

*Continued from THE JOURNAL OF GEOGRAPHY, April, Volume III, No. 4, p. 150.

celestial phenomena known at his time could be explained on the theory that the earth is the fixed center of the universe, the stars and sun revolving around it in circles, and the planets revolving in little circles whose centers move uniformly around the earth in large circles.

Copernicus (1473–1543) developed again the heliocentric theory, with references to Aristarchus, but to explain certain irregularities of motion he supposed the sun not to be in the exact centers of the various circles. His successor, Tycho Brahe (1546–1601), returned to the geocentric theory because *he could observe no changes in the directions of the stars* at different times of the year, which should vary somewhat during the year if the earth revolved around the sun. His successor, Kepler (1571–1630), returned to the heliocentric theory and discovered the three celebrated laws of planetary motion which bear his name. From his time on the heliocentric theory has been universally accepted.

These different theories did not arise from any errors in the thinking of the authors of the contradictory systems. The fact is that they had no data by means of which they could prove one was right and another wrong. Their observations, the same as nearly all of ours at the present day, were concerned only with relative motions, and one system explained them as well as another. The only proof that the great Newton (1642–1727) could give was that, by admitting the heliocentric theory, a *very simple* explanation could be given to all phenomena by means of Kepler's laws and the law of gravitation.

The first fairly direct demonstration of the motion of the earth was through the discovery of the aberration of light by the great English astronomer, James Bradley, in 1726. If rain were falling directly downward and one were standing still in it, he would be struck squarely on the top of his head by it. However, if he should walk rapidly through it, he would be struck on the forward side, or it would seem to descend slantingly, the deviation from the vertical depending both upon its velocity of descent and his rate of walking. So, also, light coming perpendicularly from a star to the plane of the earth's orbit seems to come in slantingly because of the earth's motion. The result is that the star is always apparently displaced a little in the direction of the earth's motion, the amount depending both upon the velocity of light and the velocity of the earth in its orbit. The actual amount of displacement is found by measuring the little circle which the star apparently describes in the sky in the course of a year. When the direction of the star is not perpendicular to the plane of the orbit of the earth

the results are, of course, somewhat different, but the differences are easily accounted for.

The velocity of light had been previously found by the Danish astronomer Roemer, in 1675, from observations of the eclipses of Jupiter's satellites, to be finite and about 186,000 miles per second. The one unknown quantity remaining in the problem was the velocity of the earth, which came out as it should under the heliocentric theory. Modern astronomical observations have given the aberrational constant (20″.47), and physical experiments the velocity of light (186,330 miles per second) with a high degree of precision. The resulting velocity found for the earth not only verifies its motion but also gives the size of its orbit, and therefore the distance to the sun. This is, in fact, one of the accurate methods of finding the distance from the earth to the sun.

If one were to deny the revolution of the earth around the sun, he would have to admit that all the stars in the sky describe actual small orbits, with the same apparent diameter whatever their distances, in exactly a year, and in such a manner that they are constantly ninety degrees behind the sun in its motion around the earth.

It has been remarked that Tycho Brahe abandoned the heliocentric theory because he could not detect any apparent change in the direction (technically, no parallax) of the fixed stars during the year. His reasoning was conclusive qualitatively, and failed only because the fixed stars are immeasurably more remote than the wildest imagination could have suspected, and they have such small parallaxes that he was far from being able to detect them. Every attempt at finding a star apparently displaced by the motion of the earth failed until 1838 when the German astronomer Bessel found that the little star 61 Cygni, barely visible to the naked eye, was projected on slightly different parts of the sky at different seasons.

The parallax of a star is the angle subtended by the semidiameter of the earth's orbit at the distance of the star, and equals the apparent displacement of the star due to the motion of the earth through a distance equal to the radius of its orbit. The parallax of 61 Cygni is 0″.40, an angle which would be subtended by an object an inch in diameter at a distance of about eight miles, and one exceedingly difficult to measure, involved as it is in the question of parallax with many other greater inequalities, such as the aberration, and subject to a vast number of possible errors. The distance of 61 Cygni from the earth is more than 500,000 times the distance from the earth to the sun, which is 93,000,000 miles. The nearest star in the whole sky so far as

is known, is Alpha Centauri, a bright star in the southern heavens which is 275,000 times as far from us as we are from the sun. When a star is more than 2,000,000 times as far from us as we are from the sun its parallax can not be certainly measured by present processes. In spite of the arduous labors of astronomers of many countries less than forty stars among the thousands which stud the sky have so far been found to have measurable parallaxes. The stars are so inconceivably remote that it is meaningless to us to express their distances in miles, and astronomers have come to use, instead, the time it takes light to come from them to us. The velocity of light is so great that it travels nearly eight times the distance around the earth in a second, yet it takes nearly four and one-half years for it to come from Alpha Centauri. When you look out in the south in the early evening at Sirius, the brightest star in all the sky, you see light which left it more than eight years ago, and you see light from the north star more than forty years after it started on its long journey.

If one were to deny that the apparent displacement of the stars is due to the parallactic effects of the motion of the earth, he would have to admit that nearly forty stars describe small orbits of different sizes in exactly a year, and that they are constantly on the same side of their orbits that the sun is of its orbit around the earth.

In discussing the rotation of the earth it was stated that relative motion in the line of sight may be measured by the spectroscope. Evidently this affords an independent means of testing the revolution of the earth. Suppose a star in the plane of the earth's orbit is considered, and for simplicity that it is at a constant distance from the sun. At one time of the year the earth will be approaching it with the rate of its orbital velocity, about eighteen and one-half miles per second; six months later it will be receding at the same rate. These are velocities which can be measured very easily with the powerful modern instruments, and in this way the motion of the earth around the sun has been often verified. If the star is in motion with respect to the sun the problem is equally simple. For, suppose it is receding at any rate, say, ten miles per second. At one time of the year the spectroscope will show a relative velocity of $18.5-10=8.5$ miles per second, and six months later a relative velocity of $18.5+10=28.5$ miles per second. If the observed star is not in the plane of the ecliptic, the matter is a little different but presents no difficulties.

The spectroscope has been in effective use in astronomy less than fifty years, and the observations of the kind under discussion have nearly all been made in the last fifteen years. They show the exact

motion demanded by the heliocentric theory. If one were to deny that the changes in the relative motion in the line of sight of the various stars is due to the motion of the earth around the sun, he would have to admit that all the stars move toward and from the earth with a period of one year and with velocities precisely equal to the components of motion in their direction which the earth would have if it did move around the sun.

Each of these three independent methods of testing whether the earth moves (by the aberration, by the parallax, and by the motion in the line of sight) leads directly to the heliocentric theory, or to alternatives which one can not bring himself to believe possible. The question of the earth's revolution seems to be definitely settled and it is altogether improbable that anything will ever be discovered which will throw it in the slightest doubt. It is worthy of note, though, that the actual proofs of it are quite recent, in 1726, in 1838, and in the last few years respectively.

THE SHAPE OF THE EARTH'S ORBIT

The ancients seem to have regarded it as axiomatic that all the celestial motions are uniform and in circles. The first dissenting voice was that of Kepler, who from a most laborious discussion of Tycho Brahe's observations of Mars, announced, in 1609, that this planet moves in an ellipse with the sun in one of its foci. The same thing was in a few years verified for several other planets, and it was also shown that the radius from the sun to the planet always sweeps over equal areas in equal times. These conclusions, drawn without hypothesis from observations, formed the direct foundation for Newton's demonstration of the law of gravitation which was published in the *Principia* in 1686.

An ellipse is a closed oval which has the property that the sum of the distances from any point on it to two fixed points within is constant and equal to its length. Or, it is the apparent shape of a circle when its plane is not perpendicular to the line of sight. In Figure 2, S and S' are the foci, and $\overline{PS'}+\overline{PS}=\overline{AB}$ wherever the point P may be. The eccentricity is $\overline{OS}\div\overline{OA}$. As the ellipse becomes more and more nearly circular the foci S and S' approach the center O. The orbit of the earth is so nearly circular that its eccentricity, which is .0168, can not be shown in a diagram.

To draw an ellipse easily set two pins in the paper, place a loop of thread over them of such length that there shall be a little slack, take a pencil with a small groove cut in the graphite near the point for the

thread to run in, and trace out the curve by moving the pencil so as to keep the thread always taut. In the diagram the pencil would be at P, the pins at S and S', the thread reaching from P to S', from S' to S, and from S back to P. It follows that if the curve is drawn in this way $\overline{PS'}+\overline{PS}$ is a constant and when P is at A or B it is seen that the sum equals AB.

It is sometimes supposed that the orbits of the planets are ellipses because of their mutual attractions, without which they would be strictly circular. Nothing is more erroneous, although the proofs of this statement and some of those which will follow can not be given without conisderable mathematics, and will therefore be omitted here.

Suppose the sun is at the focus S and that the planet is started from A at right angles to the line $\overline{SA}$. There is one certain velocity depending upon the sum of the masses of the sun and planet and their

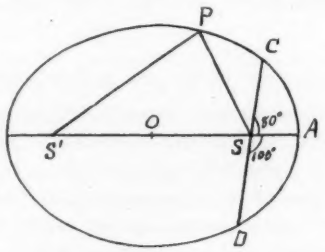

FIG. 2.

distance apart which will give a circular orbit if there are no other forces involved. A greater velocity will give an ellipse such as is drawn in the figure, the elongation being greater the greater the initial velocity. A lesser velocity will also give an ellipse, but in this case the point A will be the one farthest from the sun. Since there is only one velocity which will give a circle while an infinity give ellipses it is not in the least strange that all the orbits are ellipses instead of circles, and according to modern views the lack of circular motion indicates no imperfection in the system.

Another view which is somewhat prevalent and entirely erroneous is that the planets are so distributed that a perfect balance of forces is kept up, and that any disturbance to the system would result in its speedy collapse. The fact is that the planets interact upon each other to some slight extent, but, if every planet except the earth were removed, only a somewhat attentive observer of the sky would ever notice any difference.

As has just been stated the mutual attractions of the planets modify

their motions to some slight extent and the result is that no planet moves in an exact ellipse. These deviations from elliptic motion are called perturbations. Although the planets do not move in fixed ellipses it has been found convenient, both in analysis and popular description, to consider that they always move in ellipses, but in ones which continually change in eccentricity, position, etc. The idea has been aptly illustrated by comparing the motions of the planets with that of a bead running on a wire hoop bent into the form of an ellipse and whose eccentricity, position, etc., continually change. The bead is always running on an ellipse, but the ellipse is constantly varying.

A question of the very highest interest and importance relates to the effects of the mutual attractions of the planets upon their orbits, particularly whether the present general configuration of the solar system ever will be greatly altered or not. This is a question of great mathematical difficulty, and has not been answered with certainty for an indefinite time, but the conclusions are undoubtedly very nearly correct for perhaps several hundred thousand years. The appropriate mathematical discussion, due to Lagrange and Laplace at the end of the eighteenth century, shows that the mean distances from the sun and the periods do not change in the long run, although they are subject to short period variations; that the eccentricities and inclinations to the plane of the earth's orbit increase or decrease for many thousands of years and then change in the opposite direction, and have also short period variations; and that their lines of nodes (*i. e.*, the lines of intersection of their planes with the plane of the earth's orbit) and the lines of their major axes continually revolve in one direction, besides having short period oscillations. The amounts of change and these long periods of oscillation are different for the different planets. Thus, in the case of the earth the eccentricity which is now .0168 is slowly diminishing and will continue to decrease for about 24,000 years when it will be about .003, after which it will increase for about 40,000 years when, according to Leverrier, it will be about .078; the plane of the earth's orbit changes through an angle of 2° 40′ in the course of many thousands of years; and the line of the earth's major axis completes a rotation in the direction in which the earth moves in about 108,000 years.

CROLL'S THEORY OF THE ICE AGES

One might suppose that the questions which have just been discussed are of importance to the mathematical astronomer rather than to one whose interests are primarily in geography or geology, but the

conclusions arrived at are very far-reaching in their points of contact, as will be illustrated by an example in this section.

The point *A* (see Fig. 2) is the perihelion point and while in that part of its orbit the earth receives more light and heat from the sun than at any other time, the amount being about 1-15 more than when at *B*. If the earth's orbit had its maximum eccentricity of .078, the difference would be nearly 1-5, and if it had its minimum value of .003 the difference would be about 1-85. The earth is at *A* on December 31st and at *B* on July 2d (a variation of a day or two in these dates is possible owing to the leap year and perturbations). If the angle *DSA* equals 100 degrees, and the angle *ASC* 80 degrees, then the sun is at the autumnal equinox when the earth is at *D*, and at the vernal equinox when the earth is at *C*. If the whole year is to be divided into two seasons, winter and summer, the northern hemisphere will have winter while the earth is moving through the arc *DAC*, and summer while it is moving through the arc *CBD*. Since the area *DAC* is less than the area *CBD*, and since the radius from the sun passes over equal areas in equal times, it follows that our winters are shorter than our summers. The actual count from September 22d to March 21st, and from March 21st to September 22d shows them to be 180 and 185 days respectively. In the southern hemisphere things are precisely reversed. That is, our winters are shorter than those in the southern hemisphere, but, latitudes and other things being equal, we receive more heat daily than is received there because the earth is nearest the sun in our winter. Our summers are longer than those south of the equator, but, other things being equal, we receive less heat daily. The appropriate mathematical discussion shows, however, that corresponding latitudes in the two hemispheres receive precisely equal amounts of heat in any two corresponding seasons or proportional parts of seasons, but, owing to their different lengths in the two hemispheres, the heat is distributed throughout the year quite differently in the two cases.

About twenty years ago James Croll attempted to show that the six or seven ice ages which have followed one another in the continents of the northern hemisphere were due to the very unequal distribution of heat throughout the year, which would occur at the epochs when the eccentricity of the earth's orbit is great, and the earth at perihelion in our summer. According to this theory the glacial epochs have been separated from each other by immense periods of time, in fact, much longer than any other considerations seem to indicate. For this and other reasons which can not be entered into here, the theory is now generally regarded as incompetent, although it can not be doubted that

the causes which Croll pointed out have had considerable effects on the climate of the earth in the ages that are past, and that they will exert sensible influences in time to come.

MOTION OF THE SOLAR SYSTEM WITH RESPECT TO THE FIXED STARS

As everything on the earth, even the "eternal hills," is subject to change, so also in the heavens everything changes. The fixed stars are only relatively fixed, the configurations of the constellations being greatly altered in the course of thousands of years. With modern instruments the relative drifting of most of the bright stars and many faint ones can be detected in a year or two. These observations imply relative motions among the stars, and as the sun is a star it is only reasonable to expect that it moves with respect to the other stars.

Over one hundred years ago Sir William Herschel found that the stars in one part of the sky were apparently getting a little farther from each other, while in the opposite part they were apparently closing together. Although these motions were very slight and found only by taking averages, he boldly interpreted it as meaning that the whole solar system is moving toward that part of the sky where the spreading out occurs, and he fixed the point toward which we move as in the constellation Hercules. This constellation is almost at the zenith in our latitude the 1st of April at five o'clock in the morning, being in the eastern sky immediately before daylight. The work of one hundred years along the line of Herschel's investigation has verified his conclusions even to almost the precise point in the sky designated by him.

In the last few years the spectroscope has been applied to test the motion of the system. It would be a simple matter if the stars were not moving with respect to each other. As it is, the spectroscope gives the combined components of motion of the star and earth in the line joining them. From a large number of observations it is found that, *on the average*, the sun and the stars in the direction of Hercules are approaching each other, while the sun and the stars in the opposite direction are receding from each other. Therefore this method leads to the conclusion that the sun is moving toward the constellation Hercules with respect to the fixed stars. The spectroscope also gives, by averages, the velocity of the sun's motion, which turns out to be about eleven or twelve miles per second. The earth is thus describing a spiral around the line of the sun's way as an axis.

Some of the stars and the sun are approaching each other or receding from each other at astonishing velocities. Thus, Sirius and the sun are receding from each other at the rate of more than twenty miles

per second, or more than 300,000,000 miles annually. Although this has been going on indefinitely no observable change in the appearance of the star has taken place since scientific observations of it have been made. The reason is that this distance, great as it may be, is but an extremely small part of the vast distance between the star and us. Although Sirius is comparatively near us, as the distances to the stars go, it will be more than 800 years before a velocity of twenty miles per second will increase its distance by one per cent. Vega, the brightest star in Lyra and quite near the apex of the sun's way, and the sun are approaching each other at the rate of about fifty miles per second.

Probably the sun is moving in a sensibly straight line, for the stars are so extremely remote that their attractive influences are quite inappreciable. It is not necessary to assume, as is sometimes done, that its motion is due to the attraction of other bodies, for this implies that it was originally at rest, an assumption which is by no means necessary, and not even probable.

One possible consequence of the sun's motion remains to be mentioned, and that is that it may some time encounter meteoric matter or even collide with a star. In fact, this outcome seems to be almost inevitable, ultimately. If a collision should occur, it would result in the destruction of the present system by the enormous amount of heat generated in the impact. The combined mass would become nebulous, after which it would undergo an evolution of cooling and shrinking. Indeed, it may be that our present system has evolved from a nebulous mass generated by collisions of earlier and smaller bodies than the sun. It is fairly probable that temporary stars owe their sudden intense luminosity to the heat generated by the impact of collisions of some sort.

THE FUNCTIONS OF GEOGRAPHY IN THE ELEMENTARY SCHOOL: A STUDY IN EDUCATIONAL VALUES

BY WILLIAM CHANDLER BAGLEY
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REDUCED to its lowest terms, education consists in giving to the individual experiences which shall modify his future adjustments with reference to certain social or moral ends. Such experiences may be imparted either directly (through the individual's personal contact with the environment) or indirectly (through language or some other symbolic medium for the transmission of experi-

ence). Such experiences may function either automatically (as habit) or consciously (as judgment or reason). The problem of the science of educational values is to determine the part which the various items of the curriculum play in this process. Given any subject of instruction, for example, the question must be answered: In what different ways will this knowledge be likely to function in future adjustments? This question answered, the detailed problems of method can then be attacked: How shall we teach this subject in order that it may efficiently fulfill its function? How much time and energy shall be allotted to this subject in comparison with other departments of instruction?

The increasing importance of geography in all stages of education renders the question of values especially important. Why has this subject so suddenly assumed a position of great importance, not only in the elementary schools, but also in the high schools, the colleges, and the universities? What has caused so marvelous a change in the status of a discipline which, only a few years since, was derisively termed "the sick man of the curriculum"? An answer to these questions immediately suggests itself: A knowledge of geography has been found to be of service to its possessor. What this service is, and how the "new" geography has come to render it efficiently, when the "old" geography was inadequate for this purpose, are questions that certainly merit careful consideration.

It is obvious that one's estimation of the value of geographical facts depends entirely upon one's connotation of the term "geographical." If we include under this term only those facts that were commonly made the subjects of geographical instruction twenty years ago, we must say in all candor that such facts have but a minimum of utility for their possessor—unless, indeed, he chance to be a sailor. If, however, we mean by geographical facts all the knowledge which man has accumulated concerning his environment and its relation to his life, then the question obviously assumes a different aspect. Thus defined, geography becomes the nucleus of all the sciences that deal with natural phenomena. But geography is something more and something less than a mere blending of these various departments of knowledge. It is both more and less than astronomy plus geology plus botany plus zoölogy plus anthropology. Twenty years ago this statement would not have been true, at least in so far as the geography of the schools was concerned. Geography at that time was but a mosaic of materials borrowed from the various sciences of nature. This mosaic was not in itself a science, because it lacked a unifying principle.

XUM

The very looseness of the old definition betrays this weakness: "Geography is a description of the surface of the earth and of its countries and their inhabitants."

The unifying principle which has made geography a science is Man. Not all the facts of botany are important in geography, but only those that are directly connected with man's welfare. This does not imply that a complete treatment of geography would not perhaps involve all the facts of botany, but these would be arranged and classified with reference to this unifying principle. The pure science of botany, on the other hand, takes no account whatsoever of this principle. To all intents and purposes, a pure science is a closed system.

This distinctively human view of geography was first clearly enunciated by the great German geographer, Karl Ritter, who died in 1859. It has only been within recent years, however, that the principle has come to be generally adopted, and even to-day there are some authorities who refuse to recognize the limitations which it imposes; but even the latter would probably agree that, for educational purposes, this view of geography is the most satisfactory. Mr. Redway has summed up the matter in the following words: "The question of the nature of geography is gradually settling itself into one that inquires into the proper basis and scope of the subject. During the past twenty years we have seen public opinion throw aside the notion . . . of geography as a 'description of the earth's surface,' and substitute therefore a very broad idea, 'the study of the earth as the home of man.' . . . If I felt called upon still further to add to the literature of definition, I should put it as 'the study of man and his environment,' or, perhaps, 'life and its environment.'" *

If, then, we look upon geography as a study of the environment in its relation to the life of man, the *utilitarian* value that attaches to this subject is obvious from the outset. Broadly speaking, all life is adjustment to an environment. Anything that tends to render this adjustment more efficient is of value from the standpoint of utility. Whatever reduces waste, whatever saves time, energy, labor, whatever increases wealth and material prosperity may be looked upon as utilitarian in its value. That the facts of geography, as we now understand that term, possess such utilitarian value in a degree sufficient to warrant their wide dissemination is easily demonstrated. A few concrete instances will suffice to illustrate this point.

The process of distribution that is continually going on, tending to relieve the congested areas of the earth's surface and to populate the

* J. W. Redway: *Proceedings*, N. E. A., 1903, p. 155.

undeveloped areas, can take place either blindly or intelligently. In the former case, lack of accurate information concerning the conditions of different regions—their relative productivity, healthfulness, etc.—leads to a chance or fortuitous selection of favorable environments; that is, under conditions of geographical ignorance, migratory movements frequently entail a tremendous material waste, to say nothing of human suffering. Inadequate knowledge of climatic conditions, for example, led to the misfortunes that followed the wild rush into the semi-arid regions of Kansas and Nebraska in the early 80's. To-day the work of the various scientific bureaus of the national Government is devoted to the gathering of accurate information regarding the temperature, rainfall, fertility, and salubrity of various parts of the country. Annually a vast mass of information is collected, digested, and published—information which is, in its very essence, geographical knowledge. The pupil in the upper grades of the elementary school could and certainly should be made acquainted with the sources of this information and trained in its interpretation. The expense which is involved in the collecting of this data would be repaid in a generation, if the schools would see to it that their pupils know where to get at it and how to use it. In fact, a more intimate connection between the Department of Agriculture and the public schools is earnestly to be desired. In some instances a start in this direction has been made through the medium of the State agricultural colleges, but, as yet, it is only a start. The only possible objection that could be urged against such a correlation would come from wild-cat land companies that attempt to colonize unproductive regions. An examination of the advertising pages of recent magazines will demonstrate that such companies exist even to-day.

The merchant engaged in the export trade has no longer to send his vessels to distant shores on the chance that a market may there be found for his goods. The Consular Reports published by the Government give accurate information concerning the commercial geography of foreign countries—what goods are in demand, at what profit they can be sold, what duty must be paid for their importation, what commodities will not find a sale, and a host of other valuable facts which operate to reduce losses and increase profits. All this geographical knowledge is important, from a utilitarian point of view, to many different classes of people. It is knowledge which the merchant, the farmer, the manufacturer, and the legislator may frequently use to their advantage. And the laborer seeking a market for his labor may be just as materially benefited by such knowledge as the manufacturer seeking

a market for his products. Here, again, is a suggestion toward the making of geography practical in the elementary school. The writer once proposed this question to an eighth grade class that had been exceptionally well prepared in commercial geography: The Great Northern Railroad recently sent a representative to Asiatic Russia to study the Trans-Siberian Railroad; what motives led the management to take this step? A variety of answers were obtained, nearly all showing commendable acumen of thought. These were criticised by the class with the aid of suggestive questions, and finally the conclusion was reached that the Great Northern directors were anxious to know whether they could compete with Russia in supplying wheat for the oriental market. It is obvious that such a question of commercial geography is of vital interest not only to the stockholders of the Great Northern Railroad but also to the entire population of the northwestern States.

We have spoken so far only of the utilitarian value of detailed facts of geography. But the new geography, like all true sciences, renders deductive processes possible. From the facts are induced great principles which can, in turn, be applied to particular instances with reasonable certainty that the conclusions will be justified by actual facts. "All knowledge," says Professor Ostwald, "is prescience"; that is, the ultimate value of knowledge, as such, lies in the fact that with it one can forecast the future on the basis of the past. The value of the principles of geography, from a utilitarian standpoint, is as unmistakable as the value of detailed geographical facts. To-day we not only know, as a matter of direct observation, that certain regions are unsuitable for agricultural pursuits, but, given the contour of a certain region, given other facts of its topography, given a few hints as to its geological history, given the prevailing winds, and its distance from the sea, we can determine *a priori* its suitability for agriculture. There is, of course, a possibility of error. Actual test may overthrow the results of our theoretical considerations; but the chances are greatly in favor of their validity. An interesting example of a gigantic enterprise, based upon *a priori* reasoning from geographical generalizations, is furnished by the recent exploitation of the water power of Sault Ste. Marie. All precedents seemed to justify the assumption that a great manufacturing and commercial center should grow up at this point. Its situation near the wheat fields of the Northwest, near the immense virgin forests of Ontario, near the unrivaled deposits of iron ore in the Lake Superior region; its facilities for water communication with the most populous centers of the continent; its proximity to the labor market

—all these conditions supplemented the extensive water power developed by the rapids of St. Marys River in warranting the rosiest pictures of the future. A large corporation was organized for the purpose of developing these resources. A canal was dug on the Canadian side—cut through the solid rock—to bring the water to the turbines at a convenient point. Factories were constructed on a scale hitherto unheard of in the business world. Steamer lines were operated on the lakes, and a railroad was pushed north into the forest to bring down pulp wood and iron ore. For a time everything went as anticipated, but a few months ago the entire organization collapsed. Some important factor, no one seems to know just what, had been overlooked. Possibly the results were expected too quickly; time was not allowed for natural development. But that the fundamental conclusion was valid—that a great city will sometime grow up at this point—no one seems to doubt, even after this disastrous failure.

Does the utilitarian value of geography justify the importance which this subject has assumed in education? Is it of value to special classes rather than to the average citizen? Should the study of geography be left, in the main, to the higher institutions? Every one must know how to read and write, how to compute, how to express himself effectively; could not the time of the elementary school be spent more profitably upon such subjects as these? Upon the basis of the above considerations, and bearing in mind the fact that the majority of children never get beyond the elementary school, these questions must be answered in favor of geography. The utilitarian value of geography, however, would not justify its preëminence in the elementary school to the neglect of these other branches. Nor is the utilitarian value the only value that accrues to its study. It adds an increment, and a large increment, to the total value of the subject, but very few disciplines rest upon utility alone. It is only necessary here to point out that the utilitarian value of geography is extremely important, and that our methods of teaching must be modified in some degree by this fact. To what extent they should be modified can be determined only by a comparison of the utilitarian value with the other values which geography may possess.

We know that the prominence of certain items of the curriculum is justified, not by the utility of their facts and principles in actual application to the problems of life, but rather by the condition that ignorance of these facts and principles brands a person as uneducated, and hence serves to militate against his maximal efficiency in society. The study of grammar is, perhaps, the best instance of a subject of formal instruction,

the main value of which is *conventional*. A sentence that is grammatically incorrect may express one's thought just as clearly as a sentence that is grammatically correct, yet habitual use of incorrect forms—disregard of conventional requirements—will distract the attention of one's auditors from the thought to the form, and hence will militate against the maximal efficiency of one's expression. The question now arises: In what degree will conventional requirements justify the teaching of geography in the elementary schools?

Geographical knowledge is certainly "assumed" as part of the intellectual equipment of every one who would claim for his thoughts and opinions the consideration of the average man. The man who does not know that the earth is round will surely be handicapped in his dealings with others; for, in social intercourse, men and women generalize upon slight bases, and the man who has proved himself to be ignorant upon so common a branch of knowledge as geography will receive scant attention upon other matters. The elementary school owes it to the individual to furnish him with those geographical facts and concepts that "every one must know." In this day, when "learning by heart" has been practically banished from orthodox pedagogy, it is especially necessary to emphasize this point. A number of facts must certainly be memorized for this reason if for no other.

In addition to the value of its facts in direct application to the needs of life, and in addition to its conventional value, geography has a peculiar value as a preparation for other subjects. A knowledge of geography is especially important in the successful study of (1) history and current events, (2) literature, and (3) natural science.

(1) "History is not intelligible without geography," says a recent writer.* "This is obviously true in the sense that the reader of history must learn where the frontiers of States are, where battles are fought out, whither colonies were dispatched. It is equally if less obviously true that geographical facts very largely influence the course of history. Even the constitutional and social developments within a settled region are scarcely independent of them, since geographical position affects the nature and extent of intercourse with other nations, and therefore of the influence exerted by foreign ideas. All external relations, hostile and peaceful, are based largely on geography, while industrial progress depends primarily, though not exclusively, on matters described in every geography book—the natural products of a country and the facilities which its structure affords for trade, both domestic and foreign."

* H. B. George: *The Relations of Geography and History*, Oxford, 1901, p. 1.

It should not be overlooked, however, that the relation of geography to history is, in some measure, reciprocal—that, while geography is essential to the understanding of history, history is sometimes no less important in the rational study of geography. It is perfectly obvious that the significance of many geographical facts depends in no small measure upon historical conditions. Boundaries between countries, for example, are important geographically, yet they frequently have no adequate geographical explanation and must be interpreted entirely from historical bases. This point is also illustrated by the location of certain cities, although here a geographical influence may often be traced through historical media. For example, the capitals of the South American republics in the Andes region (including also Venezuela) are all situated away from the seacoast in all but inaccessible mountain regions. The cause of this phenomenon must be sought, not directly in geographical, but rather in historical conditions. For generations the neighboring seas were infested with pirates, and cities on the coast were constantly subject to pillage and sack at the hands of these outlaws. Nevertheless, that this historical condition should have arisen is undoubtedly due to the operation of geographical causes.

Admitting the reciprocal nature of geography and history, however, it is plainly apparent that geography is the more fundamental, hence its greater preparatory value in connection with history.

The study of geography is also essential to the rational understanding of "current events." Not to evaluate current tendencies with some degree of intelligence is certainly not to prove oneself efficient in society. In this day when an occurrence on the other side of the globe may immediately and directly influence the humblest citizen on this side, the ability to read newspapers intelligently needs no elaborate argument for its defense. And the ability to read newspapers intelligently certainly involves not a superficial but a thorough knowledge of geography, as the contemporary happenings in the Orient abundantly testify.

(2) Geography stands in an intimate relation to the study of literature. The classics commonly read in the elementary schools—*Robinson Crusoe* and *Evangeline*, to name only two—could not be adequately appreciated without a prior knowledge of geographical facts. Just what weight should be attached to geographical study upon this ground is necessarily indeterminate, but this factor certainly adds an increment, and a large increment, to its total value.

(3) Rather more tangible is the relation of geography to the natural sciences. As pointed out above, geography borrows many of its facts

from different fields of natural science—from geology, meteorology, astronomy, botany, zoölogy, etc. In the high school and college each of these sciences is treated in and for itself as a pure science—that is, without explicit reference to its economic or human relations. It is obvious, however, that the initial study of a science should be from the human side. The child should be introduced to facts and principles in their relation to his life. This is what geography attempts to do. In a sense it might be looked upon as an introduction to all the sciences of nature. It is here that the child must get that first large view which should precede all detailed and abstract study—abstract in the sense of being considered apart from its human relations. Educators are now coming to believe that the curriculum should include geography not only as a preparation for the sciences, but also as a culmination of all scientific study; that is, an advanced course in geography should form the capstone of the science work in high school or college. The student should bring together the facts and principles that he has acquired in the detailed study of the various sciences, and discover their relations to human life. This is only a consistent application of the general principle that mind begins with large wholes, passes from these to detailed parts and then back again to the wholes—analysis followed by synthesis, differentiation followed by integration. In any case, however, we can not doubt that geography has great value as preparatory to the study of science, and that, if the student is to get the most from the study of science in high school or college, he must be thoroughly grounded in geography in the elementary school. Here, however, we are speaking for the few rather than for the many. To the majority of our pupils the initial study of geography forms the sum total of their scientific instruction. Therefore the preparatory value of geography can not be unduly pressed as a justification for its preëminence in the elementary school.*

The dividing line between *practical* and *cultural* values is indeterminate. What we have discussed under the head of utility is beyond doubt "practical" in the narrowest sense of the word. But conventional values become practical when we look at them from a certain standpoint—when we remember that conventionally valuable facts aid one in one's social adjustments. The preparatory values are practical ultimately, provided that the subjects which they look forward to are in themselves practical. The values which we have now to discuss

* This would seem to indicate the fallacy of President Hall's proposals for replacing geography in the grades with elementary science. *Cf. The Ideal School* Proceedings, N. E. A., 1901.

will doubtless appeal to one as ultimately practical, although with more intermediate steps than is the case with those considered above. Because of this distinction we may class the following as cultural values, remembering, however, that the distinction between practical and cultural is one of degree rather than of kind.

Acquisitiveness in man is an instinct. Like all instincts it owes its existence to the forces of natural selection working upon fortuitous variations in nerve structure. It has been good for man to be curious about his environment, to study his environment, and to determine the laws that govern it. Primitive man did not realize, probably, that his inordinate curiosity was good for him. In his own rude way he investigated things for the mere "fun of it"—for the pleasure which it afforded him. Later in his development he came to find out that many of the facts which he discovered and many of the laws which he worked out were "good" for him—that the knowledge which he had gained helped him in solving the problems of his life. But this appreciation of the value of acquisitiveness came only after a long lapse of time.

The desire to satisfy curiosity is thus seen to be at the basis of knowledge. The child evinces this desire. His curiosity is boundless, and upon this native instinct the educator may build. It is clear, however, that he can not trust to it entirely, for the very fact that it is an instinct means that it runs its course in passive attention. It is not sustained, directed, organized. All these things mean active attention, mean *work*. Curiosity soon tires, but any measurable addition to knowledge involves persistent effort.

It is the problem of the educator, then, to replace this instinctive curiosity with a higher mental process. The desire to obtain knowledge for the sake of knowledge is not to be discouraged, but it is to be held to a definite line until results follow. Wherever possible, the child's curiosity should be directed along lines that will help him most in his future adjustments. There are times, however, when this curiosity may be directed toward ends the practical significance of which is not once apparent, and it is these cases that we must discuss under the head of cultural values.

In the first place, some children may be curious in certain special directions. They may evince a desire, perhaps, to learn all that they can about Arctic exploration. The facts that they obtain from various sources may not be applicable to the problems that they must solve in later life, yet no sensible teacher would attempt for a moment to curtail this interest. He has here the opportunity to replace instinctive

curiosity with a higher sentiment, namely, intellectual interest. This is closely akin to other forms of sentiment, such as appreciation of art, music, and literature. None of these is, in itself, "practical," yet each subserves a very practical end. Without some form of pleasure, life would be impossible. If the higher forms of pleasure—the sentiments—are not developed, the individual will be thrown back upon the primitive pleasures. He will follow the instincts, the lines of least resistance. In our school work to-day we are trying to develop the aesthetic sentiments—to cultivate an appreciation for art, music, and literature. We should certainly not neglect the intellectual sentiment—the pleasure that comes from knowing. It is for this reason that the wise teacher would never think for a moment of curtailing interest in such a subject as Arctic exploration. The opportunity is too valuable to be lost. With a little trouble he may lead the child to take delight in an intellectual pursuit, just as with a little trouble he may lead the child to see the beauty in a great picture, or a classical musical composition, or a world epic.

In the second place, items of knowledge which have little or no significance in the practical affairs of life may nevertheless be necessary to a *system* of knowledge. It is a well-known fact that systematic arrangement or organization is an extremely important factor in the "efficient recall" of items of experience at times when they are needed.* Very frequently in making a system of knowledge—in arranging the items of experience in an orderly fashion—it is necessary to insert many facts and principles which have in themselves little practical value. Thus the individual may never be called upon to apply his knowledge of the Arctic regions, but such knowledge is necessary in order to make his world view comprehensive. Without it there would be a distracting gap.

The briefest examination of the curricula of the secondary schools and colleges will serve to demonstrate the importance of the "cultural" values which we have discussed in the two preceding paragraphs. The larger part of these curricula is made up of subjects which subserve one or the other of these two functions: tending either to develop intellectual interests or to make more comprehensive and complete the body of knowledge. The science, the mathematics, the language and literature, which occupy so prominent a place in the higher education,

* The importance of "thought-connections" in recall has been demonstrated, time and again, by the methods of experimental psychology. *Cf.* The work of Ebbinghaus, Steffens, and Lobsien.

can be justified only upon these grounds. In the elementary school, on the other hand, the cultural values are not so prominent. The bulk of the time is given over to the study of arithmetic and language, the latter including reading, writing, composition, and grammar. Literature and geography divide most of the remaining time between them. Arithmetic and language are justified principally because of their utilitarian values. Literature is prominent chiefly because of its conventional and cultural values. Geography might be said to occupy a midway position, being important from all sides.

If the foregoing analysis of the aims and functions of geography as an integral part of the elementary school curriculum is valid, it follows that our methods of teaching must be organized with these points in view. If possible, the various aims should be classified with reference to their relative importance in fulfilling the general end of education; namely, the production of the socially efficient individual. We should know with approximate accuracy just what facts and principles are to be impressed because of their utilitarian value, what are essential from the conventional standpoint, what from the preparatory, and so on. In many instances the groups will, of course, cut across one another, but it seems tolerably clear that methods of impressing facts and developing principles will vary according to the function which the facts and principles are to subserve.

These are problems which it must be left for educational research to solve. From the standpoint of the practitioner, at least, this suggests a field of investigation infinitely more promising than those which contemporary educational experts are attempting to exploit.

GEOGRAPHICAL NOTES

Wind-Blown Trees.—The communication on *Wind Effects*, by Prof. M. S. W. Jefferson, in your January number, interests me much, as it concerns a subject to which I have given some attention for several years. Observations of the kind to which your contributor refers are easily made, and add much to the interest of the study of meteorology, because they give it life. If any of your readers cares to pursue this subject further, he will find an instructive discussion of it in a recent paper by Prof. J. Früh, entitled *Die Abbildung der vorherrschenden Winde durch die Pflanzenwelt* (*Jahresber, Geogr. Ethnogr. Gesells.*, Zürich, 1901–02, 97 pp.). In this study Professor Früh classifies the effects

of wind action on trees, names the most sensitive trees, and gives observations from different parts of the world. Savage tribes often make use of tree wind-vanes to guide them on their wanderings.

Apropos of wind-blown trees, I have somewhere heard a story of a gardener who, when shown a large number of trees which had been blown by the prevailing wind, and not appreciating the fact that what he saw was the result of wind action, said he could not take the place, because he could never keep all those trees trimmed at that particular angle.—R. DEC. WARD, *Harvard University, Cambridge, Mass.*

Our Proportion of the World.—"In area possessing one-fourteenth of the entire earth, in population one-twentieth, and increasing more rapidly than that of the rest of the world; in wealth one-fourth, in international commerce one-ninth, in banking power more than one-half, in savings deposits nearly one-third, in Government revenue one-tenth, in stock of gold nearly one-fourth, in stock of silver one-sixth, in amount of life insurance two-thirds, in railway mileage over one-third, in coal production one-third, in copper production one-half, in zinc production one-fourth, in iron and steel production more than one-third, in wheat crop one-fifth, in corn crop two-thirds, in cotton crop eight-tenths, in wool crop one-tenth, in output of newspapers and periodicals over one-third—this is the achievement of the United States after a century and a quarter of existence."—*Wall Street Journal.*

Primary Geography.—Years ago, as many teachers remember, such subjects as botany, zoölogy, and chemistry were taught from the written description in the text-book, but we have progressed in such a degree that any one attempting to teach now, other than objectively, would be considered on the verge of lunacy. Geography was taught in the same manner, but each succeeding year places it, too, more and more on an objective basis. We have advanced to a stage where objective teaching of every subject seems imperative. Verbal descriptions are inadequate, for, no matter how graphically you describe a place or thing, each listener is forming a different mental image, and no imagination, however clear, can create a mental picture at all correct, unless there is already in the mind suitable experience gained from actual observation of the thing described or from pictures of the object. So little do business men depend on verbal descriptions that, if they wish to construct a building, before entering into a contract for the same, they must see on paper a complete picture, that there may be no

misunderstanding. They realize "that a greater amount of information and a more lasting impression is gained from a single picture than from pages of description." We as teachers are slowly adopting business methods. We are beginning to realize the importance of securing good mental images.

We know the best means of doing this is to visit the object itself; but since we can not charter an airship and travel with our little flocks from pole to pole, nor can we import mountain peaks, seas, or rivers at our convenience, the next best means is to model them on the sand table, and at the same time present the best pictures on the subject that can be secured. Dr. Redway says that in the teaching of geography climate is fundamental, and the first topic that should be considered, as its influence has everything to do with the food, shelter, and clothing of the inhabitants of the earth. To illustrate the power of this influence, I know of nothing better than the story written by Jane Andrews of the "Seven Little Sisters," which should be in the hands of every primary teacher. It is easily illustrated and dramatized and creates a desire for the further study of geography in children of every size.—*Nebraska Teacher*, February, 1904.

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E. D. J.

EDITORIAL

GEOGRAPHY FOR TEACHERS DURING THE COMING SUMMER

THE opportunities for enlarging and improving one's geographic knowledge during the coming summer will be exceptionally varied and alluring. In fact, no such combination of geographic possibilities has ever before been possible. The numerous summer schools in the larger universities and normal schools of the country offer facilities for geographic study valuable for teachers of all grades of work, detailed announcement of which will be found in our columns this month.

It should not be forgotten, however, that much geographic training of exceeding value can be secured without tuition and that the cheap rates to the St. Louis Exposition will make it possible for many teachers to secure a wealth of information of daily use in their class work, at an expense less than would be incurred in a six weeks' summer school. The exhibits of industries and mankind at St. Louis will be exceptionally fine and will form a school of geography of an unique character. The trip to St. Louis will also give opportunity for personal study of the topographic and climatic conditions of a region of great interest to any one living amid the varied surroundings of the Eastern States. To make such a trip of geographic profit the JOURNAL will be devoted next month to the geography of the Louisiana Purchase, and will be particularly valuable as a guide book, to be read before leaving home. People may pass through the most interesting region without seeing or appreciating the geography about them. Teachers anticipating a trip to St. Louis should therefore prepare their minds for what is to be seen by securing a preliminary knowledge of the geographic possibilities during such a trip.

The studying of geography first hand, either in the field or the classroom, is obviously the best means of increasing one's power in this field. It should be borne in mind, however, that there is no single means of securing inspiration and a due appreciation of the depth and significance of geography like coming in personal contact with the men and women who are leading in geographic thought and work. This unusual opportunity will be given this summer at the meetings of the International Geographic Congress, announcement of which has been already made in these columns. This is the first meeting of the

Congress in this country, and one of the first opportunities there has been for securing the presence of geographers from abroad. Neither have there been, in the past, many chances for an assembly of the geographers of this country. All enthusiasts should attend some of the meetings of the Congress without fail! All interested in the subject will gain inspiration and help from listening to the papers and meeting their fellow workers.

Thus, in at least three different ways, opportunities for growth in geography are possible this summer. It is to be hoped that every teacher will therefore take advantage of these conditions, which may not be duplicated again for many years. Summer schools increase in number and worth constantly; World's Fairs, cheap cross-country trips, and assemblies of geographers are rare. They therefore must be taken advantage of at the moment.

REVIEWS

New Physical Geography. By Ralph S. Tarr. Pp. xiii, 457. The Macmillan Co., New York, 1904.

Tarr's New Physical Geography is, as the author announces in his preface, a "new book" as compared with his earlier texts; and, as we should expect, is in most respects a distinct improvement upon them, although their excellence is attested by the number of editions through which each of them has passed.

This text seems best adapted to the last years of the high school, where the subject is more and more finding place; and the author has evidently adapted his treatment alike to the requirements of those who expect to go to college, and to the much larger class who get their only training in earth-science in the high school. So we find here much that, in the opinion of the strict constructionist, would not belong to physical geography.

By his "Topical Outlines," "Questions," "Suggestions," and lists of "Reference Books," giving publishers and prices, at the end of each chapter, the author has done an invaluable service for the vast army of teachers who are called upon to teach physical geography, but who have not been specially trained for the work. These will thank him also for his suggestions as to "Laboratory Equipment" and "Field Work," appendices J and K.

The topical summaries, excellent as they are, can not be considered an unmixed advantage, as they are an ever-present temptation to neglect the longer consideration that precedes them. Many teachers, too, prefer to have their scholars make their own summaries.

The illustrations are both appropriate and attractive; but considering the size and weight of the book, possibly too numerous. In a few instances they are not as near their appropriate texts as could be desired, and the excessive number of bracket references to them seems confusing. A special word of praise is due the block drawings, and more of these could have been profitably used.

The treatment of the Land before the Atmosphere is not logical, nor does the author's reason for it seem sufficient. Such treatment must be either empirical, which the book before us is far from being, or to the scholar unintelligible. The study of physiographic features in their evolutionary development presupposes a knowledge of the air. It is unfortunate, too, that the author has seen fit to give even less space to his consideration of the air than he gave in his "First Book."

Most of the appended matter might better find place under its appropriate topic in the body of the text; and a fuller treatment, at the end of each chapter, of the response of organic forms to their physical environment would make unnecessary their separate treatment in chapters XVII and XVIII, which are too largely biological.

There is not the logical arrangement of topics in sequence that one would expect, and in some cases topics are considered out of what would seem their proper setting. Thus *superimposed* and *rejuvenated* rivers, and *river piracy* are considered under the subject of plateaus rather than under rivers.

A few unfortunate omissions occur, as on p. 45 where *gravity* is omitted from the agents of erosion, and p. 50 where *slope of the land* is not mentioned among the factors determining the amount of run-off.

The author's use of "divide" is at least unusual, and leaves no place for *undivided* regions.

The treatment of tides and ocean currents are alike unsatisfactory; and the mistake is made of considering *rising* and *flood* tide coincident in period, and likewise *falling* and *ebb* tide.

A very small number of typographical errors have crept in, as on p. 259 where "southeast trades" and "northeast trades" should be interchanged, and in Fig. 325 where –35 is evidently not intended.

Chapters XV, XVI, and XIX are distinct additions to the excellence of the book.

In spite of these minor roughnesses, many of which can be remedied in a later edition, the New Physical Geography will easily take its place among the very best texts on physical geography available. W. R. C.

A Laboratory Manual for Physical Geography. By Frank W. Darling. Size 9¾ x 8½. Exercises 32. Chicago: Atkinson & Mentzer, 1903.

The growing emphasis laid upon laboratory work in physical geography is evidenced by the steadily increasing number of laboratory manuals. The breadth of the field and the lack of unanimity in regard to what the essentials in laboratory work really are is clearly shown by the radical differences which these various manuals present to the laboratory teacher.

The manual under consideration contains thirty-two exercises; of these, six illustrate various problems in mathematical geography, seven treat of the atmosphere, while nineteen pertain to the lands. The apportionment is certainly unfortunate. The topic of the ocean has been entirely omitted, and that of the atmosphere, which lends itself so admirably to laboratory investigation, has received scant attention. While no one can question the importance of the land as a subject of study, the causal relation existing among the various elements of climate and weather may be so clearly demonstrated that this topic seems plainly entitled to an emphasis approximately equal to that which the lands receive. In this book, however, the author disposes of the subject of climate summarily—a single exercise on planetary winds being practically the extent of treatment. The topic of the

weather is studied by means of daily weather observations, with the addition of one or two exercises on cyclonic storms.

The treatment of the lands is excellent—adequate in scope, detailed in character, and of a nature requiring careful observation and clear thinking.

The exercises dealing with mathematical geography are so suggestive that one can not help wishing for an amplification in this case also. The relation of the earth to the other heavenly bodies becomes more a matter of fact and less a matter of faith to the pupil, who makes direct though simple observations of the heavens, according to the plan outlined by the author, than to one whose knowledge of this field is gained through laboratory equipment and text-books.

While the omissions in the volume under consideration are of a serious nature and greatly impair its usefulness, its strong points and its valuable suggestions should recommend it to every teacher of physical geography either in a secondary or in a normal school. C. B. K.

The Yellowstone National Park. By Hiram M. Chittenden. Fourth edition, revised and enlarged. Pp. vii, 355. Cincinnati: The Robert H. Clark Company, 1903.

Chittenden's well-known volume on the Yellowstone National Park has lately appeared in a new and up-to-date edition, which forms one of the best guides to this "Wonderland." The book is almost equally divided into an historical and a descriptive section. The historical portion is extremely interesting, and gives the salient points in the history of this region in a small compass. For any one who is unfamiliar with the current beliefs in reference to the veracity of the early explorers in this region, Chittenden's volume will form a welcome introduction to some interesting history.

Most people who use the volume will, however, get the greatest help from the descriptive portion of the book. The descriptions are written in clear, accurate, unassuming language, in strong contrast to the railroad folder style so common in descriptions of the indescribable. This portion of the book is also practical for the tourist, as it includes a detailed account of the customary "tour" as well as descriptions of the animals, plants, geological history, and hot springs. In fact the volume is one of the necessities to the visitor.

The illustrations are excellent, and the statistical material well selected. Unfortunately, however, the author has referred but infrequently to the work of the many noted scientists who have unraveled the story of the history of the Park, and then in such a careless way that no one could readily find the original articles. This is a serious defect in a book descriptive of a National Park, and written by an officer of the United States army, especially when most that is known about the Park has been due to the indefatigable energies of Government officers, some of whom have practically given their lives to the task. R. E. D.

RECENT PUBLICATION

The Philippine Islands, 1493–1898. Edited and annotated by Emma H. Blair and James A. Robertson. Vol. X, 1597-1599, pp. 318. Vol. XI, 1599–1602, pp. 318. Cleveland, Ohio: Arthur H. Clark Company, 1904.

Like the preceding volumes in the series, these volumes are of especial value to students of historical geography.

THE LOUISIANA PURCHASE

The Mississippi Valley was destined to become the core of the nation as it was of the continent. Its fertile soil would support a dense population, and its cheap waterways were to prove of inestimable value for a young, agricultural people. The acquisition of the new West prolonged greatly the most distinctive feature of American anthropo-geographic conditions — the abundance of free land. A nation is influenced not only by the topography, but by the size of its territory. The presence of the new West reacted most wholesomely upon the East and the old West; the stimulating effect of inexhaustible opportunity never allowed American energy to abate, and the democratic spirit of the ever youthful frontier fostered the spirit of democracy and youth in the whole nation.

ELLEN CHURCHILL SEMPLE

XUM